TR-1196
September 15, 1972

JOHN F. KENNEDY SPACE CENTER

DELTA-90

INTERPLANETARY MONITORING PLATFORM-H (IMP-H)

OPERATIONS SUMMARY

(NASA-TM-X-68880) DELTA-90 INTERPLANETARY MONITORING PLATFORM-H (IMP-H) Operations Summary Report (NASA) 15 Sep. 1972 38 p CSCL 25B

N73-13907

Unclas
G3/31 50143

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SECTION I
MISSION

A. MISSION OBJECTIVE

The IMP-H project objectives are the study of solar and galactic cosmic radiation, solar plasma and wind, energetic particles, electromagnetic field variations, and the interplanetary magnetic field. IMP-H will be launched by a Delta model 1604 vehicle designated Delta-90.

B. LAUNCH VEHICLE AND SPACECRAFT DESCRIPTION

1. Launch Vehicle. Delta-90 (figure 1) is a three stage vehicle having six solid motors strapped to the first stage for thrust augmentation. The prime contractor for the vehicle is the McDonnell Douglas Astronautics Company (MDAC). Pertinent vehicle data are presented in table 1.

2. Spacecraft. The IMP-H spacecraft (figure 2) manufactured by the Goddard Space Flight Center (GSFC) has structure improvements and modifications which are based on advances in the state-of-the-art and new spacecraft requirements. Geometrically, the structure is a 16-sided drum measuring 53.402 inches across flats and 62.125 inches in overall height. It consists of an aluminum honeycomb shelf supported by eight struts and an 18-inch diameter thrust tube on the underside. The experiment modules are mounted on the topside of the shelf. To satisfy the stringent RF and thermal requirements, the experiment section is fully enclosed by metallic covers and side panels. Three solar array rings are used to supply power to the experiments and electronics when in orbit. Two of the rings are mounted above and one below the experiment section. Appended to the exterior of the structure are two experiment booms approximately 11 feet long and two Attitude Control System (ACS) booms four feet long. These booms fold alongside the spacecraft and are deployed at a preselected time and sequence in orbit. The IMP-H spacecraft life expectancy is in excess of two years. Further pertinent spacecraft data are presented in table 2.

After injection into final orbit, the spacecraft will be reoriented by the on-board ACS to adjust the spacecraft perpendicular to the ecliptic plane. This maneuver is necessary to satisfy restraints imposed by certain on-board experiments which require the spin axis-sun angle to be consistently 90 degrees.

C. MISSION PLAN

1. Launch Constraints.

a. Launch Window. The launch window will open at 2122 EDT on September 21, 1972, and will close at 2139 EDT; on September 22, 1972 the window is two minutes earlier, opening at 2120 and closing at 2137 EDT.

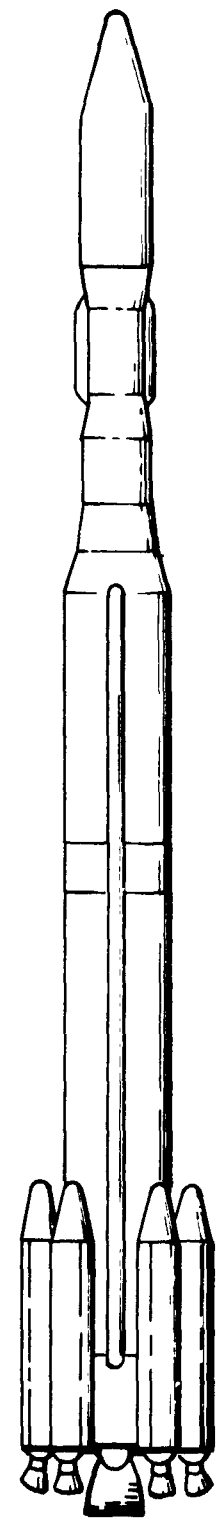

Figure 1. Delta-90 Launch Vehicle

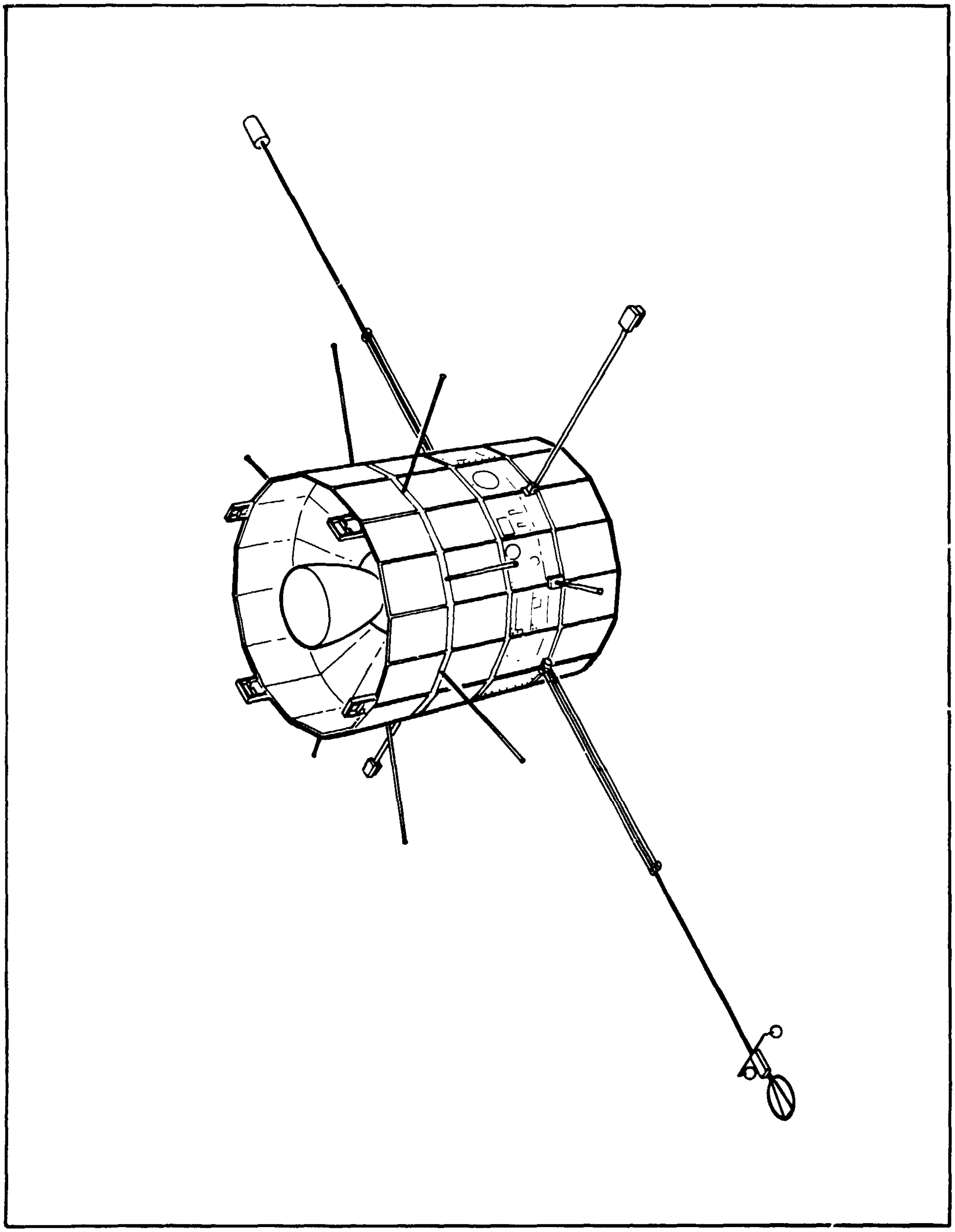

Figure 2. IMP-H Spacecraft

Table 1. Delta-90 Vehicle Data

	Boosters	Stage I	Stage II	Stage III
Length (feet)	19.7	74.0	18.87	6.17
Diameter (inches)	31	96	60.0	37
Engine type	Solid	Liquid	Liquid	Solid
Engine manufacturer	Thiokol	Rocket-dyne	Aerojet	Thiokol
Designation	TX354-5	MB3-III	AJ10-118F	TE-364-18
Number of engines	6	1 (+2VEs)	1	1
Specific impulse	237.6	252.4	306.3	285.5
Thrust (pounds/engine)	52,150	172,000	9,606	14,600
Burn time (seconds)	39	265	325	43.6
Propellant	TP-H7036	-	-	TP-H-3062
Fuel	-	RJ-1	A50	-
Oxidizer	-	Lox	N_2O_4	-
Nitrogen gas (psig)	-	3,000	4,400	-
Helium gas (psig)	-	1,200	4,000	-
Serial number	340, 341, 342, 343, 344, 345	20006	20003	40018

Table 2. IMP-H Spacecraft Data

Weight (pounds)	860.0
Height (inches)	62.1
Diameter (inches)	53.4
Electrical power	152 watts (maximum)
Experiments (engineering)	3
Experiments (scientific)	13

b. Launch Vehicle. All vehicle in-line subsystems must be operational at launch as required by the operations parameters in the countdown manual. Since all primary test objectives are associated with the spacecraft, there are no vehicle mandatory requirements on telemetry; however, if a telemetry channel carrying critical information becomes inoperative during countdown, it is sufficient cause for a hold to review the effects on post flight data analysis.

The Air Force Eastern Test Range (AFETR) stations supporting Class 1 requirements must be operational or the mission could be delayed.

c. Allowable Wind Conditions. The maximum allowable wind velocity which the vehicle in any configuration can safely withstand when it is erected on the pad with gantry around it is 64 knots. The maximum wind velocity which the vehicle can safely withstand when it is erected and with gantry removed is 43 knots.

The Go-No Go decision for upper wind conditions is based on a computer program at MDAC Santa Monica and is a combination of wind shear, velocity, and direction factors.

2. Flight Plan. The IMP-H spacecraft will be launched from Complex 17, Pad B, Cape Kennedy Air Force Station (CKAFS), Florida, on September 21, 1972. The pad azimuth will be 115 degrees and the vehicle will roll to 95 degrees shortly after liftoff placing the spacecraft into an elliptical transfer orbit as illustrated in figures 3 and 4. A kick motor will be fired at apogee to place the spacecraft in a nearly-circular earth orbit. Final orbit parameters are listed in table 3. Following despin and boom deployment, the ACS will orient the spin axis normal to the ecliptic plane and adjust spin rate.

Table 3. IMP-H Orbit Parameters

Apogee	39 earth radii
Perigee	35 earth radii
Inclination	28.75 degrees
Period	12 days

The nominal sequence of events from liftoff thru yo weight release is presented in table 4. Times are in seconds after liftoff (T+seconds). Those events which occur after Main Engine Cutoff (MECO) and Sustainer Engine Cutoff (SECO) are also referenced as M+seconds and S1+seconds.

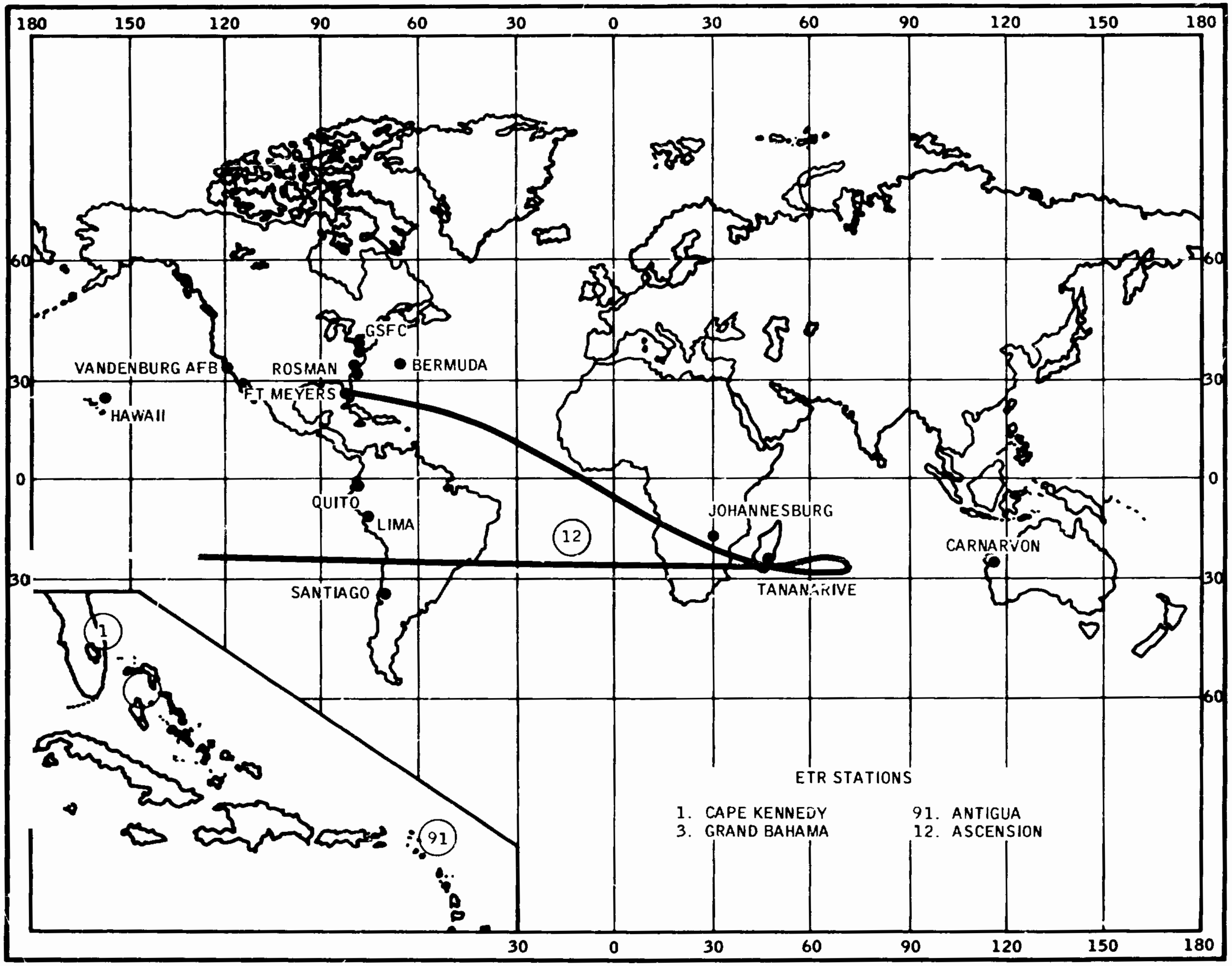

Figure 3. Spacecraft Tracking and Trajectory

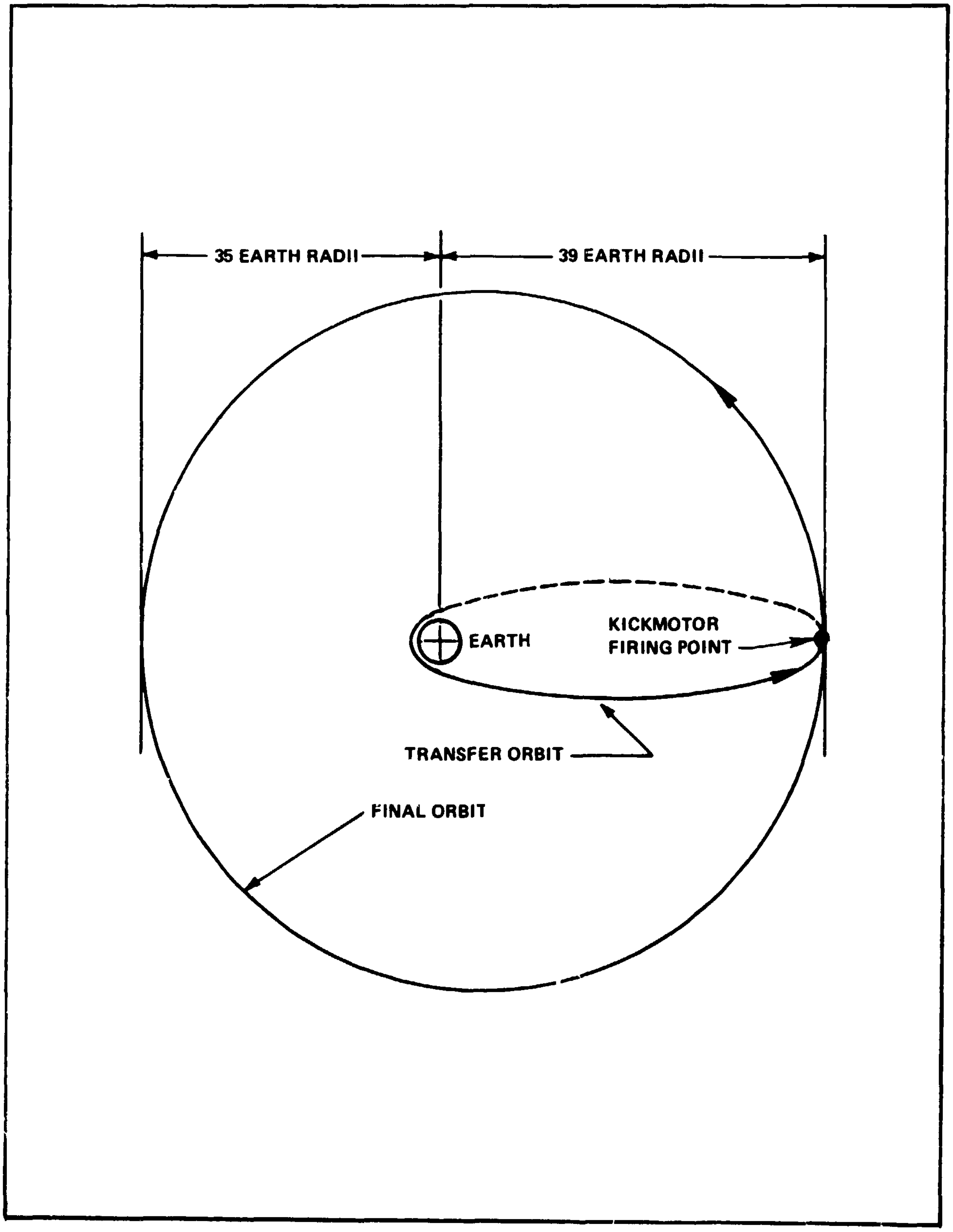

Figure 4. IMP-H Orbital Path

Table 4. Sequence of Flight Events

T+Sec	Min:Sec	Event	Initiated By
T-0.2	-00:00.2	Ignition solid motors	FIP switches
		Start solid motor separation timer	Solid motor ignition relays
T+0	00:00.0	Liftoff	
		Initiate open loop guidance	DIGS
T+2	00:02	Begin stage I roll program	DIGS
T+6.5	00:6.5	Begin first pitch program	DIGS
T+6.5	00:6.5	End stage I roll program	DIGS
T+11.0	00:11.0	End first pitch rate	DIGS
T+14.0	00:14.0	Begin second pitch rate	DIGS
T+25.0	00:25.0	End second pitch rate	DIGS
T+25.0	00:25.0	Begin third pitch rate	DIGS
T+38.0	00:38.0	Gain change - pitch, yaw, roll	DIGS
T+38.2	00:38.2	Solid motor burnout	DIGS
T+40.0	00:40.0	End third pitch rate	DIGS
T+40.0	00:40.0	Begin fourth pitch rate	DIGS
T+50.0	00:50.0	End fourth pitch rate	DIGS
T+50.0	00:50.0	Begin fifth pitch rate	DIGS
T+60.0	00:60.0	End fifth pitch rate	DIGS
T+60.0	00:60.0	Begin sixth pitch rate	DIGS
T+85.0	01:25.0	Solid motor separation command	Solid motor timers
		Accumulator purge on	Solid motor timers

Table 4. Sequence of Flight E ?nts (Cont'd)

T+Sec	Min:Sec	Event	Initiated By
T+85.0	01:25.0	End sixth pitch rate	DIGS
		Begin seventh pitch rate	DIGS
		Feedback shaping network gain change	DIGS Discrete 30 on
		Filter and gain change - pitch, yaw	DIGS
		Gain change - roll	DIGS
T+110.0	01:50.0	End seventh pitch rate	DIGS
		Begin eighth pitch rate	DIGS
T+120.0	02:00.0	Start guidance	DIGS
		Gain change - pitch, yaw	DIGS
T+240.0	04:00.0	Enable MECO	DIGS discrete 31 on
T+245.2	04:05.2	Switch to velocity only steering	
T+260.2	04:20.2	Stop computing guidance steering corrections	GS
T+261.2	04:21.2	Stop Stage I closed loop guidance	DIGS
T+265.2	04:25.2	MECO	FIP switches
		VE enable/main engine lockout	DIGS discrete 29 on
		Stage II hydraulic pump on (back-up)	DIGS discrete 7 on
		Arm stage II ignition and pyrotechnic power	DIGS Discrete 12 and 13 on
		Pressurize tanks	DIGS Discrete 22 on

Table 4. Sequence of Flight Events (Cont'd)

T+Sec	Min:Sec	Event	Initiated By
T+265.2	04:25.2	End eighth pitch rate	DIGS
		Filter and gain change - pitch, yaw	DIGS
T+268.2 (M+3.0)	04:28.2	Remove tank pressurization discrete	DIGS Discrete 22 off
		Close tank pressurization valve (SECO discrete on)	DIGS Discrete 5 on
T+271.2 (M+6.0)	04:31.2	VECO	DIGS Discrete 32 on
T+273.2 (M+8.0)	04:33.2	Blow stage I/II separation bolts	DIGS Discrete 2 and 28 on
		Remove SECO discrete	DIGS Discrete 5 off
T+274.2 (M+9.0)	04:34.2	Remove stage I discretes	DIGS Discrete 29, 30, 31 32 off
		Filter and gain change, pitch, yaw, roll	DIGS
T+276.2 (M+11.0)	04:36.2	Remove separation discretes	DIGS discrete 2 and 18 off
		Pressurize tanks	DIGS Discrete 22 on
T+277.2 (M+12.0)	04:37.2	Start stage II engine	DIGS Discrete 3 on
		Filter and gain change - pitch, yaw	DIGS
		Filter and gains to gas jet control - roll	DIGS
T+278.2	04:38.2	Remove tank pressurization and engine start discretes	DIGS Discrete 3 and 22 off
T+290.0 (M+14.7)	04:50.0	Begin first stage II pitch rate	DIGS

Table 4. Sequence of Flight Events (Cont'd)

T+Sec	Min:Sec	Event	Initiated By
T+290.0 (M+14.7)	04:50.0	Start guidance	DIGS
T+295.0 (M+29.7)	04:55.0	End first stage II pitch rate	DIGS
		Begin second stage II pitch rate	DIGS
		Fairing separation	DIGS Discrete 4 on
T+297.0 (M+31.7)	04:57.0	Remove fairing separation discrete	DIGS Discrete 4 off
T+530.2 (M+265.0)	08:50.2	Gain change - pitch, yaw	DIGS
T+552.2 (M+287.0)	09:12.2	Switch to velocity only steering	DIGS
T+598.2 (M+333.0)	09:58.2	Initiate check on thrust pressure switch	DIGS
T+599.2 (M+334.0)	09:59.2	Stop computing guidance steering corrections	DIGS
T+601.2 (M+336.0)	10:01.2	Stop guidance	DIGS
T+602.2 (M+337.0)	10:02.2	SECO	DIGS Discrete 5 on
		End second stage II pitch rate	DIGS
		Turn off hydraulic pump	DIGS Discrete 7 off, 6 on
		Change pitch/yaw filters and gains to gas jet control	DIGS
T+540.0 (S1+37.7)	10:40.0	Begin third stage II pitch rate	DIGS

B

Table 4. Sequence of Flight Events (Cont'd)

T+Sec	Min:Sec	Event	Initiated By
T+662.2 (S1+60.0)	11:02.2	Enable CDR turnoff	DIGS Discrete 27 and 28 on
T+663.2 (S1+61.0)	11:03.2	Turn off CDRS	DIGS Discrete 27 off
T+740.0 (S1+137.7)	12:20.0	End third stage II pitch rate	DIGS
T+870.0 (S1+267.7)	14:00.0	Initiate coast guidance No. 1	DIGS
T+920.0 (S1+317.7)	15:20.0	Stop coast guidance No. 1	DIGS
T+925.2 (S1+322.9)	15:25.2	Fire spin rockets	DIGS Discrete 10 on
		Start stage III ignition time delay	
		Start stage III sequence timer	
T+926.2 (S1+323.9)	15:26.2	Fire stage III wire cutters	DIGS Discrete 11 on
		Remove spin rocket discrete	DIGS Discrete 10 off
T+927.2 (S1+324.9)	15:27.2	Blow stage II/III separation bolts	DIGS Discrete 14 on
		Fire retros	
T+940.2 (S1+337.9)	15:40.2	Stage III ignition	Pyrotechnic time delay
T+983.8 (S1+381.5)	16:23.8	Stage III burnout	Depletion
T+1085.2 (S1+482.9)	18:05.2	Payload separation	Stage III sequence timer
T+1087.2 (S1+484.9)	18:07.2	Release yo weight	Stage III sequence timer

D. POST LAUNCH OPERATIONS

During the early-orbit phases of the mission, control of the GSFC ground support facilities utilized in support of the IMP-H mission will be the responsibility of the Tracking and Data System (T&DS) directorate. Control of ground support facilities will be exercised from the GSFC Operation Control Center (OPSCON).

SECTION II
LAUNCH OPERATIONS PLAN

A. OPERATIONAL AREAS

1. Complex 17. All launch and pad operations during final countdown are conducted from the blockhouse at Complex 17 by the MDAC Test Conductor. Countdown readiness and status of the booster and spacecraft stages are the responsibility of the appropriate contractor test conductors. Overall management of launch operation is the responsibility of the Unmanned Launch Operations (ULO) Directorate. The ULO Test Controller functions as the official contact between test personnel and the ETR. The ULO Spacecraft Operations Engineer in the blockhouse coordinates spacecraft activities and reports spacecraft status to the test conductor.

2. Hangar S. The spacecraft checkout area is located in Hangar S, and is connected by data circuits and voice communications with the computer checkout equipment at GSFC.

3. Building AE. Two IMP-H mission operational areas are located in Building AE. These are the Mission Director's Center (MDC) and the Launch Vehicle Telemetry Ground Station. In addition, an observation area is provided behind the MDC for observing overall mission progress. Figure 5 shows the location of the launch and operational areas.

The launch operations and overall mission activities are monitored by the Mission Director in the MDC (figure 6) where he is informed of launch vehicle, spacecraft, and tracking network flight readiness. From the information presented, the Mission Director will determine whether or not the mission will be attempted. Appropriate prelaunch and realtime launch data are displayed to provide a presentation of vehicle launch and flight progress. The MDC also functions as an operational communications center during launch operations.

The front of the MDC consists of large illuminated displays including a list of tracking stations, Range stations in use, plotting boards, and a sequence of events after liftoff.

Three plotting boards are located at the center of the display and are used to show present position and Instantaneous Impact Prediction (IIP) plots and, in most cases, doppler information. These displays, when plotted with the theoretical plots, give an overall representation of the launch performance.

The following information will be displayed in the MDC during IMP-H launch operations:

a. TV

b. ETR test number

c. Greenwich Mean Time (GMT) and Eastern Daylight Time (EDT) synchronized to WWV

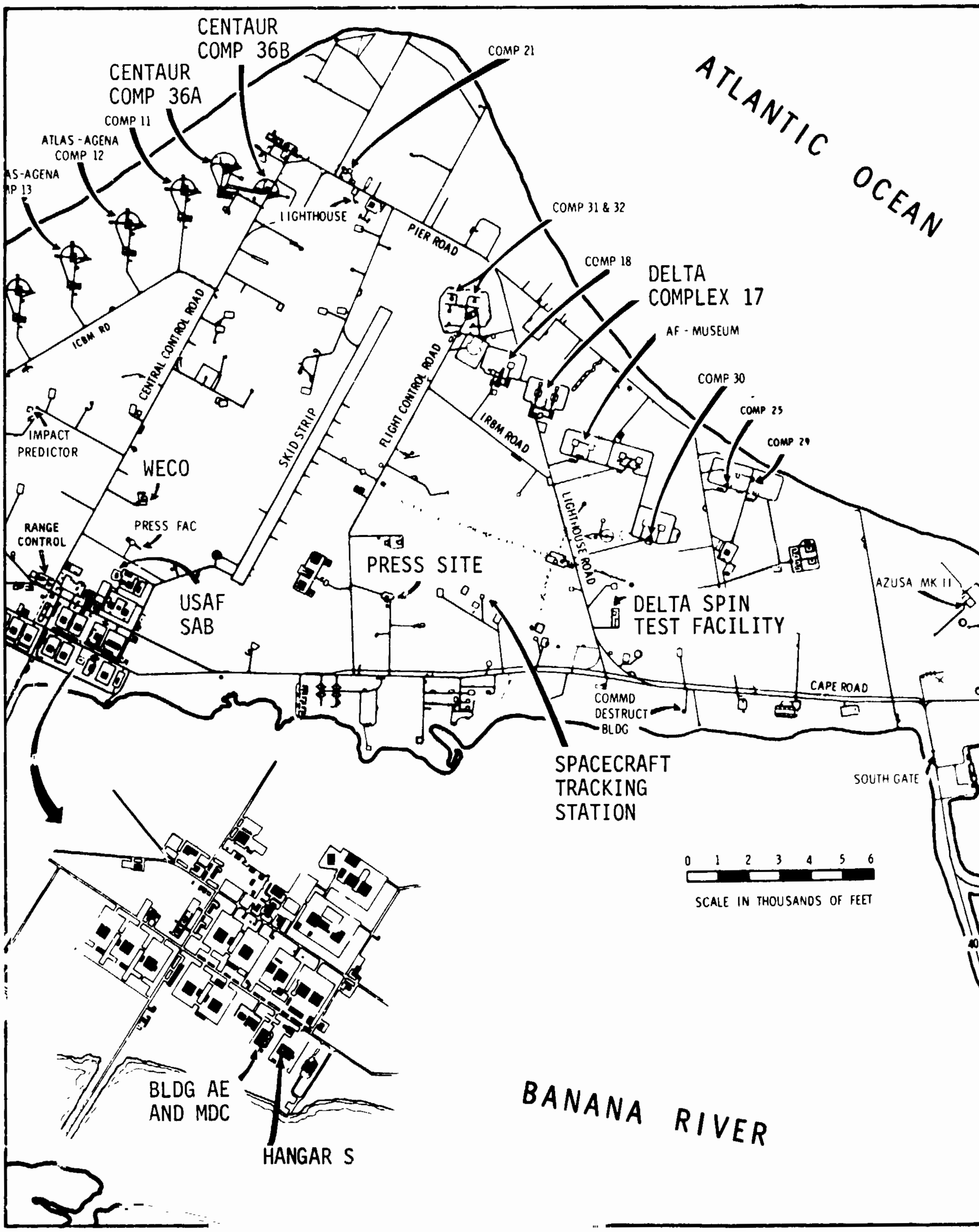

Figure 5. Launch and Operational Areas

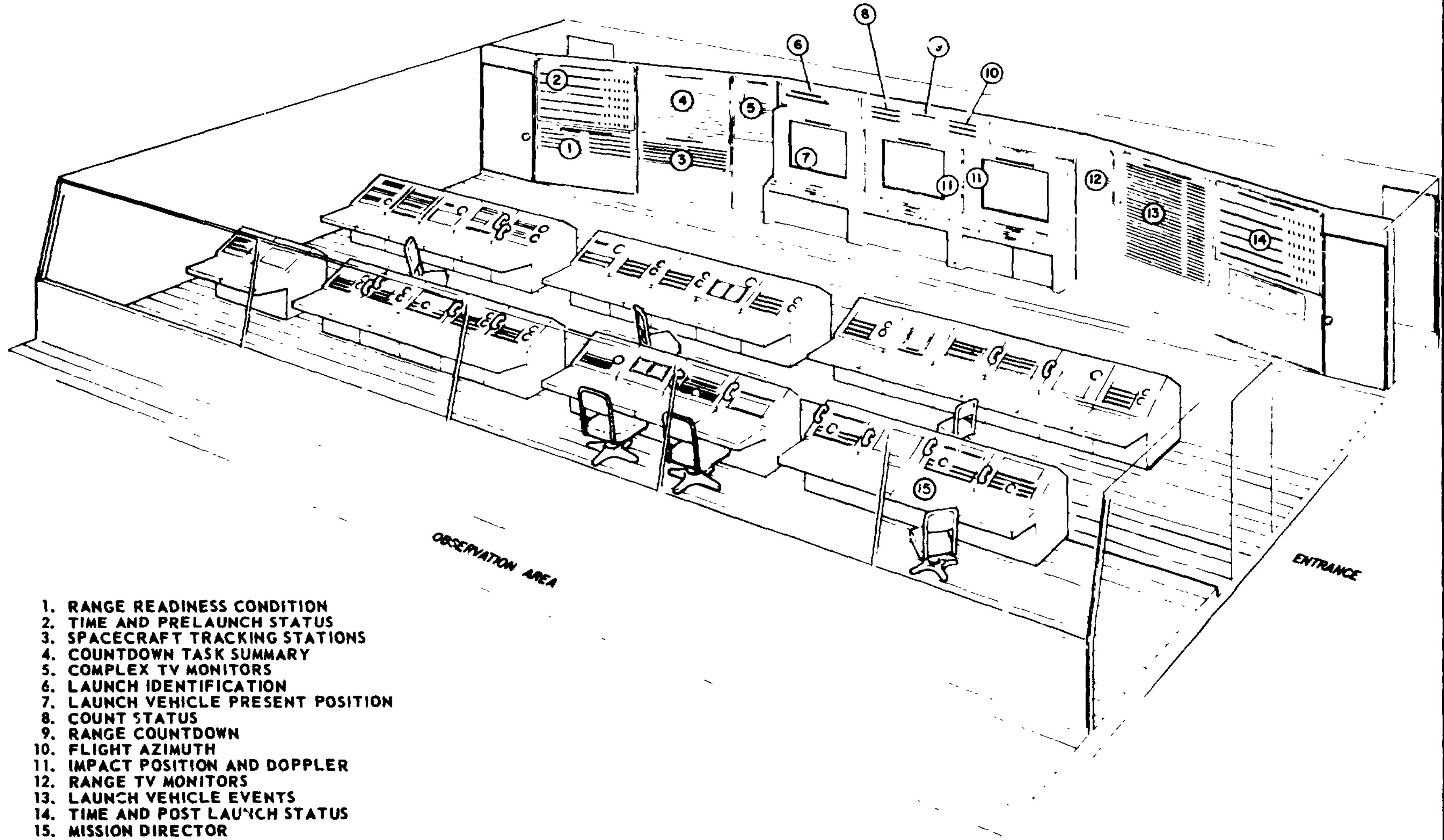

Figure 6. MISSION DIRECTOR'S CENTER

d. Time remaining in launch window

e. Predicted liftoff time

f. Built-in hold time

g. Countdown progress

h. Range readiness

i. Countdown task summary

j. Spacecraft stations readiness

k. Impact prediction

l. Doppler

m. Launch azimuth

n. Post liftoff vehicle events

o. Present position

The ULO Launch Vehicle Telemetry Ground Station receives, monitors, and records launch vehicle telemetry signals during prelaunch checkout to assist in determining vehicle launch readiness. After liftoff, realtime analysis of telemetry data will be used to determine vehicle performance for display in the MDC.

4. Spacecraft Tracking Station (STS). The STS will provide prelaunch spacecraft checkout support, consisting of frequency and power measurements, as requested by the spacecraft checkout team. In addition, launch vehicle and spacecraft telemetry signals will be remoted from the STS to Building AE in realtime.

B. DATA ACQUISITION

Telemetry, optical, and radar data will be supplied by a composite of ETR, GSFC and KSC stations. The support requirements of various stations are described in the following paragraphs; the geographical location of the various stations are presented in figure 3.

1. Vehicle Telemetry.

a. Uprange Telemetry. During the prelaunch operations, the checkout data will be received, recorded, and displayed in realtime at both the Complex 17 station, operated by MDAC, and the Building AE station, operated by KSC/ULO. The AE station will display all channels telemetered, and systems engineers will observe the data at both sites to determine the flight readiness of the vehicle. Both stations will display the realtime data post-test for flight evaluation prior to the post-flight critique.

Data will be received at both sites through their respective local antennas until liftoff, with switches to other stations made as required to optimize the coverage. STS and CIF will provide early launch phase data to AE. Building AE will send the best of AE, CIF, or STS data to Cx-17. Complex 17 will therefore have the best data available. 100 percent coverage is anticipated through the switch to Antigua data at about T+400 seconds.

b. Downrange Telemetry. Antigua (ETR station 9.1) is the prime downrange station for early launch. A composite of stage II and III data (see table 5) will be remoted to the Cape via the two subcable circuits. The PCM will be on the higher frequency subcable circuit remodulated on an IBM data modem. This data will be demodulated at TEL IV and sent to AE for display. The other channels will be directly placed on the lower frequency circuit. This data will be sent to Building AE and Cx-17 for realtime flight analysis and to TEL-4 for the range safety display. This will probably be the only station viewing SECO.

Table 5. Antigua Retransmission

Retransmit VCO	Vehicle VCO	Data
	High Freq Cable	
IBM Modem	2-G	PCM
	Low Freq Cable	
C	2-E	PDM
14	3-14	Pitch Accelerometer
13	3-13	Yaw Accelerometer
12	3-12	Low Level Thrust Accelerometer
11	3-11	Chamber Pressure
10	3-15	High Level Thrust Accelerometer
9	2-9	Chamber Pressure
8	2-8	Roll Jets
7	2-7	Pitch Jets
6	2-6	Yaw Jets
5	2-10	Yaw Control Signal
4	2-11	Pitch Control Signal

An ARIA aircraft will support in the interval between Antigua LOS and Ascension AOS. It will receive and record only, but will dump the data to Antigua for relay up the subcable to AE on the way back to the staging base. This aircraft will be the only source of stage III spinup, ignition, and burnout information; therefore, this information will not be available in realtime.

Ascension Island will view a portion of the coast phase, and both the MSFN site (ACN) and the ETR site (station 12 or ASC) will remote 14 channels of information on coast performance to AE and Cx-17 for analysis. (See tables 6 and 7.) The rest of the STDN, as applicable, will receive and record until battery depletion.

2. Spacecraft Telemetry.

a. Uprange. The spacecraft 136 MHz signal (PCM/PM) will be received in Hangar S and recorded at GSFC using data modem techniques, and using the Hangar S antenna system (fixed) up until late terminal count. At that time, the data will switch to STS video and will stay with STS video until LOS. It is anticipated that 100 percent coverage will be obtained. AE will back up STS with a redundant high gain antenna system. The MILA USB site will also receive, record, and remote spacecraft data to GSFC.

b. Downrange. Antigua will receive and record the spacecraft signal. Realtime remoting is not possible due to the [illegible]t rate.

All data beyond this [illegible] will use STDN sites directly to GSFC, with relay to Hangar S.

c. DTS Operations. The DTS systems in Hangar S, utilizing a 203 data modem, will remote all data as seen in the IMP station to GSFC. This includes all minus count operations through STS LOS. In addition, command signals from GSFC will be sent to the van/spacecraft, via another modem for command checkout. After liftoff, the best data at GSFC (ASC, Johannesburg, Carnarvon, etc.) will be remoted to Hangar S for two days for backup systems analysis by the checkout team using modems. All decommutation is done at GSFC. Certain display information is also remoted to Hangar S for checkout use using additional modems.

3. Tracking. ETR radars will track through parking orbit insertion and ETR will provide range safety and orbital parameters based on this data. Radars 0.18, 1.16, 19.18, 3.18, 7.18, and 91.18 may be used for this purpose. In addition, STDN radars will be used to provide final stage II orbital parameters.

The only tracking of the final orbit after stage III burn will be through use of the GSFC range and range rate system using the spacecraft 136 MHz signal. Accurate final orbits from GSFC should be available shortly after Johannesburg LOS.

STS will Doppler track the spacecraft signal through T+520 seconds. Antigua will also support and verify SECO. The STS and Antigua data will be remoted to the MDC and GSFC for display in realtime.

4. Miscellaneous Other Support.

a. STS will send the countdown to GSFC on the Digital Doppler System.

Table 6. Ascension Island Realtime Data, Manned Space Flight Network

Vehicle VCO	Data
	Line No. 1
3-14	Pitch Accelerometer
2-G-4 (DAC Shift 3)	Pitch Attitude Error
2-7	Pitch Jet
2-E-20	Control Battery Voltage
2-E-27	N_2 Regulated Pressure
2-G-2 (DAC Shift 2)	Roll Attitude Error
2-8	Roll Jets
	Timing
	Line No. 2
3-12	Low Level Thrust Accelerometer
2-G-6 (DAC Shift 3)	Yaw Attitude Error
2-6	Yaw Jets
2-E-38	He Regulated Pressure
2-E-43	Engine Battery Voltage
2-E-15	Stage III Spin Up
2-E-14	Stage III Separation
	Timing

Table 7. Ascension Island Realtime Data, Eastern Test Range

VCO	Vehicle VCO	Data
		Line No. 1
1	2-G-4 (DS-3)	Pitch Attitude Error
2	2-7	Pitch Jets
3	2-G-2 (DS-2)	Roll Attitude Error
4	2-8	Roll Jets
5	2-E-27	Nitrogen Regulator Pressure
6	2-E-16	Nitrogen Bottle Pressure
7	2-E-7	G. C. Logic Voltage
8	-----	Time
		Line No. 2
1	2-G-6 (DS-3)	Yaw Attitude Error
2	2-6	Yaw Jets
3	2-E-20	Control Battery Voltage
4	2-E-21	Instrumentation Battery Voltage
5	2-E-43	Engine Battery Voltage
6	2-E-22	Oxidizer Tank Pressure
7	2-E-35	I.M.U. Logic Voltage
8	-----	Time

b. AE will remote mark events to GSFC using 16 VCO's (2 sets of IRIG 1-8). (See table 8.)

c. The MILA USB site will track the vehicle and spacecraft and will supply data tapes if requested.

d. A block diagram of the overall data flow is presented in figure 7. Table 9 presents the wideband multiplexer assignments.

5. Optics. Twenty-three fixed engineering sequential cameras will provide coverage from T-4 minutes to T+30 seconds. The Melbourne Beach long range tracking camera will track from acquisition to Loss of Vision (LOV). Seven tracking engineering sequential cameras will provide photographic coverage from liftoff to LOV. Twenty-three documentary cameras are assigned to the mission.

C. METEOROLOGICAL PLAN

Cape Kennedy Forecast Facility (CKFF) will provide Weather Warning (WW) services from the time the booster is erected on the pad until launch. WW notifications will be issued whenever surface winds are forecast to exceed 34 knots and/or electrical storm activity is expected within 5 nautical miles of Complex 17. F-5 Day forecasts of general surface and upper air conditions will be made available to the Test Requirements and Scheduling Office (TS-NTS-1) upon request. An upper winds forecast to 60,000 feet in 1,000-foot increments will be provided on F-2 Day. This forecast will include predictions of cloud cover, ceiling, visibility, surface winds, precipitation, and temperature. On F-1 Day, a forecast containing the same elements as on F-2 Day will be made. At T-10 hours, the F-1 Day forecast will be confirmed or modified and this will again be done at T-4 hours. In addition, the Assistant Staff Meteorologist will be available at the CKFF from T-4 hours until the test termination.

Minimum ceiling and visibility requirements will be as described by Range Safety. Upper air limitations, wind shears and wind speeds will be determined by computer evaluation at MDAC Santa Monica from the latest forecasts.

Table 8. AE to GSFC Realtime Remote

Line	Vehicle VCO/Segment	Group I Remoting VCO	Function
2241.5	G-2	1	Roll Attitude Error
2241.5	G-4	2	Pitch Attitude Error
2241.5	G-6	3	Yaw Attitude Error
2241.5	G-25	4	X-axis Acceleration
2241.5	G-1	5	Roll Rate
2241.5	G-3	6	Pitch Rate
2241.5	G-5	7	Yaw Rate
		Group II	
2244.5	FM-S	1	Sequence No. 1
2241.5	E-12	2	Event Group No. 6
2241.5	E-20	3	Control Battery Voltage
2241.5	E-23	4	Hydraulic System Pressure
2241.5	E-27	5	Nitrogen Regulated P
2241.5	G-86	6	Correction in Time to Go
2241.5	FM-A	7	X-axis Vibration
		8	Time

Note: A. Sequence No. 1 (a) MECO, (b) Fuel Float Switch, (c) LOX Float Switch, (d) VECO.

B. Event Group No. 6 - (a) ARM 1 and 2, (b) 1/2 Sep. Signal

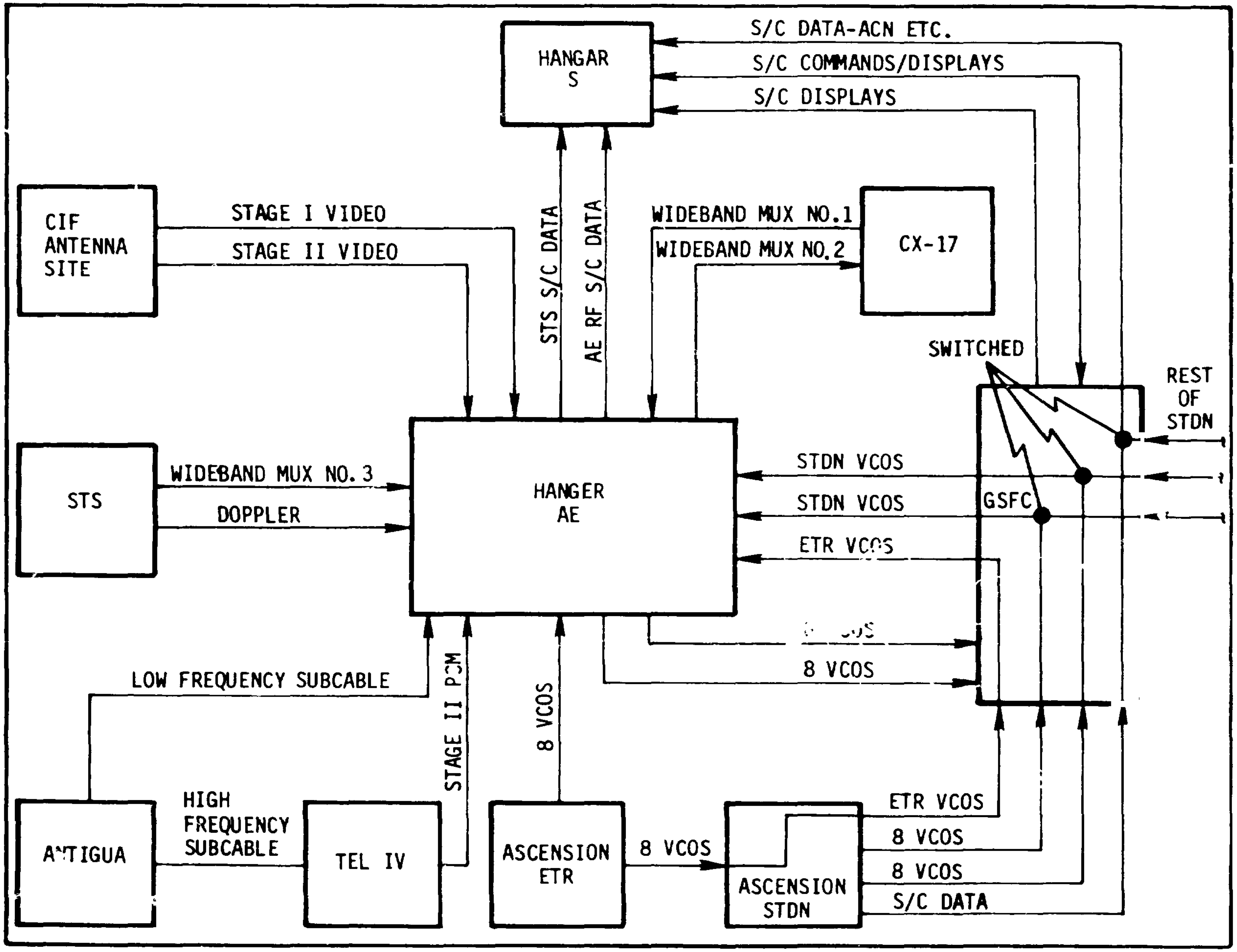

Figure 7. IMP-H Data Flow

Table 9. Wide Band Multiplexer Assignments

MUX No. 1 - Complex 17 to AE	
1	Stage I Video
2	Stage II Video
3	VETS
4	PCM Direct
5	Spare
MUX No. 2 - AE to Complex 17	
1	CIF Stage I/Ascension STDN No. 1
2	CIF Stage II/Ascension STDN No. 2
3	Antigua Lo
4	Antigua Hi
5	Ascension ETR No. 1
MUX No. 3 - STS to AE	
1	Stage I Video
2	Stage II Video
3	Stage III Video
4	S/C Video
5	Spare

SECTION III
COMMUNICATIONS

A. GENERAL

The operational communications facilities which will be available for support of the IMP-H launch are described in this section. These facilities will be available for prelaunch checkout and early post-flight intercommunications. The ULO MDC located in Building AE is the principal center of communications for launch activities.

B. MISSION DIRECTOR'S CENTER COMMUNICATIONS

Consoles in the MDC (figure 6) provide the Mission Director and assigned MDC personnel with all the communications systems required to monitor and participate in vehicle and mission progress. The communications facilities provide the means for communicating with Cape stations (Blockhouse 17, STS, and Range Control Center), downrange stations, NASA Headquarters, GSFC, and other NASA centers, and the worldwide tracking stations.

1. Black Telephones. The telephones used in this system are special dial telephones installed in the consoles. The black telephones enable MDC personnel to place or receive local and long distance calls. Each individual assigned to a console may listen to or participate in more than one call if required.

2. Green Telephones. The ETR green phone system utilizes individual phones on key panels with a limited number of users. It provides rapid, direct communications between all sites participating in the launch operation. The system has standby batteries and cannot be incapacitated by commercial power failure.

3. Operational Intercommunication System (OIS). The OIS is a Range intercom system which operates on a channel-select basis rather than on an individual station-to-station basis. All end instruments in the same working area are connected in parallel. Access to individual channels may be limited to certain operators. When an operator selects a channel and talks, all other operators who have previously selected the same channel will hear him, conversely, he will hear all other operators talking on the same channel.

During launches, various operations are assigned a specific OIS channel. Because of this assignment system and the limited number of channels available at some of the outlying stations, it is mandatory that only assigned channels be used. After vehicle liftoff, flight performance will be summarized in realtime on OIS Channel 2. All personnel may switch to Channel 2 on a listen only basis.

4. Operations Conducted on OIS. The operations to be conducted on OIS channels during the IMP-H launch are listed in table 10.

Table 10. OIS Prelaunch Operations Channel Assignments

Complex 17 Channels	Complex 17 Channel Title	Operation
1	Test Conductor	Countdown, including terminal count
2	Chatter 1	Post liftoff oral account of flight events
3	Paging	
4	Chatter 2	
5	General Test	Doppler Coordination
6	First Stage	Ordnance and RF systems destruct checks
7	Second Stage	
8	Tower Removal	
9	Digs Alignment	
10	Spare-1	
11	Spare-2	
12	Spacecraft-1	Spacecraft checks
13	Spacecraft-2	
14	Eyeball	Post liftoff, Project Officer to MDC
15	SRO	
16	NASA TC	
17	NASA Project	Project Official's use
18	Spare-3	
19	Spacecraft-3	
20	Spare-4	

SECTION IV
TEST OPERATIONS

A. GENERAL

Prior to F-3 Day, significant spacecraft and vehicle milestones are accomplished preliminary to final prelaunch operations. These events are presented in tables 11 and 12.

Table 11. Spacecraft Prelaunch Milestones

Event	Location	Date
Spacecraft ETR arrival	Hangar S	8/18/72
Spacecraft performance checks	Hangar S	8/23/72 8/29/72
Spacecraft moved to spin test building	Spin test building	9/5/72
Spacecraft mated to third stage	Spin test building	9/9/72
Mated to launch vehicle	Complex 17B	9/11/72

Table 12. Vehicle Prelaunch Milestones

Event	Location	Date
Stage I ETR arrival	Hangar M	7/23/72
Stage II ETR arrival	Hangar M	7/23/72
Stage III arrival	ETR	7/1/72
Stage I erection	Complex 17B	7/27/72
Stage II erection	Complex 17B	8/8/72
Simulated Flight Test	Complex 17B	7/12/72

B. F-3 DAY

The milestone activities accomplished during F-3 day are listed in table 13.

Table 13. F-3 Day Milestone Countdown

Time (EDT)	Event
0730	Contractor countdown initiation
0730	Flight program verification
0730	Spacecraft checks
1330	Power on stray voltage checks
1530	Power off stray voltage checks Class B ordnance hookup
1930	Spacecraft checks

C. F-2 DAY

The milestone activities accomplished during F-2 day are listed in table 14.

Table 14. F-2 Day Milestone Countdown

Count (Min)	Time (EDT)	Event
	0530	TE-364 hookup and destruct connection
	0730	Spacecraft final preps
	0930	Fairing installation Stage III ignition S&A control demonstration
	1430	Stage I solid motor ordnance installation and hookup
	1530	Fairing ordnance installation and hookup

D. F-1 DAY

The milestone activities accomplished during F-1 day are listed in table 15.

Table 15. F-1 Day Milestone Countdown

Count (Min)	Time (EDT)	Event
	0730	S&A check (PAA ordnance area)
	0730	Spacecraft checks
	0730	Stage II propellant service preps
	1130	Stage II propellant servicing
	1630	Stage I fueling
	1830	Stage I engine preps
	1830	QD wire routing
	2030	Start built-in hold

E. F-0 DAY

The milestone activities accomplished during F-0 day are listed in table 16.

F. TERMINAL COUNTDOWN

The terminal countdown starts at T-120 minutes and includes two built-in holds totaling 60 minutes. The first hold (50 minutes) occurs at T-110 minutes, the second hold (10 minutes) occurs at T-7 minutes. After completion of the second hold the countdown picks up at T-7 minutes and continues thru liftoff.

The milestone activities accomplished during the terminal countdown are listed in table 17.

Table 16. F-0 Day Milestone Countdown

Count (Min)	Time (EDT)	Event
T-922	0500	Built-in hold ends
T-922	0500	Guidance system checks
T-922	0500	Spacecraft checks
T-742	0800	Range safety system checks
T-712	0830	Class A ordnance hookup
T-562	1100	Final preps Hold fire checks LCE warmup Gantry removal
T-262	1600	Solid motor single point arming
T-172	1730	Deck plate removal
	1730	TC briefing
T-120	1822	Start terminal countdown

Table 17. Terminal Countdown

Count (Min)	Time (EDT)	Event
T-120	1822	Terminal count Stage I turn on
T-110	1832	Built-in hold (50 minutes)
T-110	1922	Built-in hold ends Lox loading
T-75	1957	DIGS crew to azimuth bldg.
T-60	2012	Helium loading Nitrogen loading
T-30	2042	Beacon external Transmitters (2) external
T-28	2044	Final beacon checks
T-26	2046	Hydraulics on (both stages)
T-25	2047	Auto slews
T-16	2056	Command carrier on
T-15	2057	CDR's on (both stages)
T-9	2103	Range arm check on internal
T-7	2105	Built-in hold (10 minutes)
T-7	2115	Built-in hold ends Stage III telemetry external
T-5	2117	Stage I fuel tank pressurized Stage III ignition S&A arming
T-4	2118	Stage I telemetry internal Stage I E-package internal Stage I solid motor power internal Pressurize stage II Lox tank Stage II hydraulics on external

Table 17. Terminal Countdown (Cont'd)

Count (Min)	Time (EDT)	Event
T-3	2119	All stage II systems on internal
T-2	2120	SRO clear to launch
T-90 sec		Spacecraft final report
T-60 sec	2121	Eng. recorders to high speed
T-15 sec		Final topping report
T-10 sec		Arm igniters Enable engine control
T-5 sec		Open solo vent valve
T-2.6 sec		Engine start
T-0	2122	Liftoff